Northeastern Forest Experiment Station

Upper Darby, Pa.

BI-MONTHLY REPORT ON

FOREST INFLUENCES AND FLOOD CONTROL SURVEYS

December 1, 1950

FLOOD CONTROL SURVEYS

By Arthur Bevan

GENERAL

Rainfall and runoff continued deficient during October in the Northeastern territory. This condition continued until the middle of November when several storms brought above normal precipitation and increased runoff.

These culminated on November 25, when two storms moved in--one from the southwest and the other, which developed over the Central Atlantic Coast, from the south. These storms caused record snowfall in West Virginia, Ohio, Western Maryland, and Western Pennsylvania and from 2" to 4" of precipitation in the territory east of these areas.

The latter storm was accompanied by winds that ranged from 50 to 70 miles per hour with gusts that exceeded 100 miles per hour.

While no major floods occurred in the area affected, practically all minor streams and tributaries were in flood east of the Allegheny Mountains, causing very heavy aggregate damages. Major rivers mostly reached flood stage but only minor flooding occurred, except in tidal areas where exceptionally high tides caused extensive flooding. Several lives were lost.

Twenty-five billion gallons of water were stored in the New York City reservoirs in one day during this storm.

SURVEY ACTIVITIES

The tentative draft of the Merrimack Report, to be submitted for review by FIARBC regional agencies, state officials, and other interested parties, is in process of completion.

Field work on the Salt River (Ky.) survey has been completed and compilation and analysis of the data is proceeding rapidly. Data on "going" programs is being collected.

Work on watersheds in New York-New England territory has been started with assembly and collection of data for land-use inventories. Work started to date is in the Maine Rivers and western New York-Hudson River drainages.

STATUS OF F. C. SURVEYS

Connecticut River.--In process of review by Washington staff.

Merrimack River.--Tentative draft in process of completion.

Allegheny River.--Rough draft of report about 65 percent complete.

Salt River.--Field work completed covering all phases. Compilation and analysis of data started.

COOPERATION WITH SOIL CONSERVATION SERVICE

Delaware and Youghiogheny River reports being reviewed by Washington office. Station and Regional review completed.

Roanoke River report in process of review by Washington office. Station and Regional review completed.

Field work on the forestry phases of the Lower Susquehanna watershed has been completed and compiled. Work has been started on the woodland program.

A PE report for the Raritan (N.J.) watershed has been reviewed and comments submitted.

PERSONNEL

Harold Barrett has transferred from the George Washington National Forest to the Division of Flood Control Surveys at Upper Darby.

MEETINGS

The first meeting of the New England-New York Inter-agency Committee was attended by Harper and Rettie. This was an organization meeting to plan procedures and assign responsibilities.

Whelan attended a meeting in Boston of the National Water Pollution Control Advisory Board. The meeting was to discuss pollution problems in New England with state and other officials. Field trips were made to inspect pollution problems in the vicinity of Boston.

FOREST INFLUENCES

by H. C. Storey

GENERAL

Studies of soil freezing in the northeast have been expanded to include a wide range of temperature and land uses and conditions. Some 36 plots have been installed at each of six study locations. Two plots are located in each of about 18 land uses and conditions at each study location. Observations of (1) frost structure and depth and (2) snow depth and water content will be made twice weekly on each plot throughout the winter and until the end of the spring thaw.

Study locations are as follows:

1. Maine, Penobscot Experimental Forest and vicinity.
2. New Hampshire, Bartlett Experimental Forest and vicinity.
3. Massachusetts, Hopkins Experimental Forest and vicinity.
4. Northern New York, Paul Smiths Experimental Forest and vicinity.
5. Southern New York, West Branch Delaware River.
6. Northeastern Pennsylvania, Pocono Experimental Forest and vicinity.

The study is designed to show the effect of the various land uses and conditions upon occurrence, type, and depth of soil freezing. The effect of these same conditions upon snow accumulation and melt will be determined. Past measurements have indicated the significance of the effect of many land uses and conditions upon soil freezing and have given some indication of the quantity. The present study samples a number of new conditions, particularly in forested areas, and will give a better measurement of the quantity of soil freezing (both areal extent and depth) that may occur.

In addition to the field studies of soil freezing, laboratory studies have been started at Pennsylvania State College. Here freezing in soils of different physical and humus characteristics will be studied under conditions of controlled temperature and moisture content. A large part of the first phase of this work will be devoted to the development of a satisfactory technique. The study will be carried on by a graduate student in the School of Forestry under the direction of Dr. W. C. Bramble. Assistance in planning the study was provided by members of the Station staff.

DELAWARE BASIN RESEARCH CENTER

by H. C. Storey

DILLDOWN WATERSHED

September 30 marked the end of the second hydrologic year for which data have been collected on the Dilldown watershed. Most field measurements have been tabulated and compiled in preparation for a publication on the Delaware-Lehigh Experimental Forest which is now being prepared.

Precipitation

An isohyetal map of average annual precipitation for the State of Pennsylvania shows the Dilldown area as receiving about 45 inches. Average precipitation on the Dilldown watershed for the water year 1948-49 was 49.93 inches and for 1949-50, 45.12 inches. Thus, 1948-49 may be considered as about 10 percent above normal and 1949-50 about normal.

The following tabulation shows the distribution of precipitation by months for the two years:

Month	Hydrologic Year	
	1948-49	1949-50
	Inches	Inches
October	1.80	2.63
November	5.78	2.59
December	5.28	4.04
January	4.80	3.92
February	3.00	4.75
March	1.58	6.07
April	5.24	2.56
May	7.24	4.35
June	1.02	3.18
July	4.12	5.62
August	6.04	2.25
September	4.03	3.16
Total	49.93	45.12

Most of the precipitation fell as rain. During the winter of 1949-50 very little snow fell until February 3, 1950. Between this time and February 24, 1950, the average snow depth on the watershed built up to 9.8 inches with a water content of 2.7 inches. This melted down to 4.0 inches depth and 1.2 inches water content by March 20. Another snow period increased the pack to 10.0 inches and water content to 2.7 inches by March 24. Snow had disappeared by April 3.

Streamflow

Streamflow for the water year 1949-50 totalled 26.70 inches as compared with 25.41 inches for 1948-49. At first glance this may seem surprising due to the fact that about 4.8 inches more precipitation occurred in 1948-49 than in 1949-50. Closer examination will show that a large part of this greater precipitation for 1948-49 fell during the months of July, August, and September when evapo-transpiration losses were heaviest and little of the precipitated water contributed to streamflow during this period.

The following tabulation shows the distribution of streamflow by months for the two years:

Month	Hydrologic year	
	1948-49	1949-50
	Inches	Inches
October	.35	.80
November	1.01	1.17
December	2.20	2.07
January	4.88	3.02
February	3.01	2.16
March	2.41	5.50
April	3.47	3.95
May	4.89	2.68
June	1.26	2.14
July	.69	1.88
August	.69	.76
September	.55	.57
Total	25.41	26.70

Ground Water

Ground-water elevations as measured at two of the observation wells averaged a little higher during the 1949-50 year than during 1948-49. During each year the difference between the highest and lowest level was 20 feet. On September 30, 1949, the average of the water elevation at the two wells was 1875.8 feet above mean sea level, on September 20, 1950, the elevation was 1877.2 feet. The highest level reached in 1948-49 was 1895.8 feet while in 1949-50 the peak was 1897.4. The record for both years shows a steadily dropping water surface during July, August, and September. During these months some 14 inches of rain fell in 1948-49 and about 11 inches in 1949-50. All of this water was used to replace evapo-transpiration losses.

Three additional shallow dug wells have been added near the stream to give a better picture of ground-water conditions.

Water Quality

During the period from January to September, 1950, seven water samples were collected from Dilldown Creek at the streamgaging station and analyzed for mineral constituents usually found in natural waters. The results indicate that throughtout the year, water falling on the area picks up only very small quantities of dissolved solids, either from the surface or from underground sources. In general, the concentrations of the constituents for which tests were made are about as low as any found in waters from Pennsylvania. Only silica, sulfate, and total dissolved solids exceeded concentrations of three parts per million. The water appears to be typical of that draining from forested areas of this general region where the underlying rock is mainly a siliceous sandstone. It is low in concentrations of dissolved solids, the hydrogen-ion concentration ranges from 4.5 to 6.0 pH, and some color has been added from organic matter in the swampy areas.

Bacteriological analyses indicate the water satisfies the U. S. Public Health Service standards for domestic water supplies. Presumptive tests in lactose broth showed no gas formation in nine samples after 48 hours.

Water temperature measurements made in the stream at the weir at periodic intervals during 1949-50 show a range from 33° F. to 68° F. The low reading was on March 9, 1950, and the high on July 14, 1950.

Storm of November 24-25, 1950

During the height of the storm wind velocities as high as 88 miles per hour were observed at the fire tower on the Dilldown watershed. This is considerably less than the 105 MPH reported from the vicinity of New York City.

The rain during this storm averaged about 4.25 inches on the Dilldown watershed. Peak streamflow from the watershed exceeded any since records were started in 1948, amounting to about 55-60 c.s.m. The exact amount must await extension of the rating curve for the weir.

Meetings and Visitors

Walter Langbein and Luna Leopold of the U.S.G.S. visited the watershed and went over the plan of research and inspected installations. Storey then accompanied them to southern New York State and inspected the watershed study installations being maintained by the U.S.G.S. This study has been described in a report by Gordon Ayer. Intended to determine the effect of old field planting operations upon water yield, this study so far has shown no measurable effect, although some of the plantations are closing and average 15-25 feet high. One of the chief reasons for this may be due to the fact that the ground water table is quite close to the ground surface in a large part of the planted area. One ground water well shows a fluctuation of water surface from one or two feet below the ground surface to slightly above the ground surface. Most of the wells had water standing at less than five feet below the surface. It seems that these areas have limited storage capacity, so little change in water relations could be expected. On the better drained slopes, hardwood forests covered the area so no planting was done there, hence no change.

Bethlahmy, Reigner, and Storey attended a meeting of the Anthracite Center Advisory Committee and conducted a number of members over the Dilldown watershed.

Personnel

Bethlahmy and Reigner have spent considerable time during November laying out plots for the soil freezing study.

Raymond G. Zorzi was hired on a temporary status to take frost and snow observations in the West Branch of the Delaware River in southern New York.

MOUNTAIN STATE RESEARCH CENTER

By George R. Trimble, Jr.

Fernow Experimental Forest

Work during this period was devoted primarily to weir improvements and installation of equipment. Completion of the weirs has been delayed because it was found necessary to pave a large part of several of the basins. The rock formation in the area is fractured sandstone and shale with numerous cracks. It was necessary to seal securely all the cracks inside the stilling basin which allowed water to flow around the ends or under the dam wall. This work has been complicated by the presence of numerous wet-weather springs and tree roots in the fractures, which interfered with the paving of the basins. However, four of the five basins have now been permanently leak-proofed and the last one is partly done.

All of the rain-gage sites have been selected and a start made on clearing out the trees on them.

Report on Revegetation of Strip Mine Areas

The report on a study to determine tree species suitable for the revegetation of strip mine spoil banks in West Virginia has been reviewed and is undergoing an editorial revision.

The demand for information on how to revegetate spoil banks has increased as the stripped area has increased. Unfortunately, the present status of strip mined areas in this state offered only a limited opportunity to determine planting guides. The revegetated spoils have been revegetated only a short time; the area planted is small; and the number of species used is limited. For this reason it was necessary to draw upon the experience gained in other areas where better opportunities have existed for revegetation studies. To do this the conditions of stripped areas in West Virginia were related to conditions where more comprehensive studies have been made. Thus, the revegetation guide presented in our report is based partly on findings in West Virginia and partly on a translation of findings in other areas as they apply to conditions here. As local experience becomes available these recommendations should be strengthened and expanded.

The pertinent findings from this survey and the resulting recommendations are:

1. Ninety-five percent of the spoil banks in West Virginia can be successfully planted to trees within a year or two after stripping.

Spoils with a pH below 4.0 do not revegetate well either naturally or artificially. Such spoils constitute the unplantable five percent of the total spoils area. Evidence indicates that within ten years the acidity in practically all of these spoils will be reduced to a point where revegetation is practicable. Aside from acidity there are no critical natural factors preventing tree revegetation.

2. Natural revegetation to trees is considerably delayed. The droughty conditions found on spoil banks may account for this. Bare spoil surfaces become hot and dry; the roots of most young seedinglings do not penetrate deep enough to obtain a sufficient water supply. Apparently many seedlings germinate but most of them succumb when the weather gets hot and dry. Planted trees, with their already developed root systems, fare much better.

3. Direct seeding offers definite possibilities for cutting costs but more research is needed before recommendations can be made. One of the principal obstacles to direct seeding in general is the destruction of seed by rodents. It appears that rodents are much less likely to infest spoil banks and consequently planted seeds have a greater chance of germinating. Direct seeding of red oak has been tried on a limited scale. At the end of the first growing season both survival and growth were good. However, the effect of droughty conditions could not be determined in this case because the summer was unusually wet.

4. Early spring planting is recommended to reduce heaving and winter killing.

5. Ungraded or partially graded spoils appear to offer better planting sites than completely graded spoils. It is believed that the compaction resulting from leveling with heavy equipment decreases both survival and growth of young trees.

6. The following species are recommended for spoil bank planting in West Virginia where the pH is 4.0 or higher:

   Conifers--Red pine, pitch pine, Jack pine, Virginia pine.

   Hardwoods--Black locust, yellow poplar, red maple, sycamore.

A work of caution is warranted concerning two of these species. Red pine should not be planted at elevations below about 1500 feet. Virginia pine may not be suitable for planting at very high elevations. Until more information is available it would not be wise to plant it about 2500 feet unless it is found growing naturally nearby.

Black locust is the superior tree for erosion control and site rehabilitation.

In addition to the recommended species, numerous others are adapted to many of the spoils but more experience and research are needed before the conditions under which they would be successful in West Virginia are understood.

The principal aims of these recommendations are to produce a tree cover which will reduce or prevent surface runoff, erosion, stream pollution, and reservoir sedimentation; heal the scars on the land; and build up the site so that the land will become productive once again. If the trees planted on spoil banks accomplish these objectives, the costs of revegetation will be more than justified. In addition, these trees may produce a crop which the owner can sell.

Visitors

Dr. William E. McQuilkin spent several days here reviewing the strip mine revegetation report. He visited a number of stripping operations and examined several planted and naturally revegetated spoil banks as background for his review of the manuscript.

Agriculture-Forest Service-Upper Darby